UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
|---|---|---|---|---|
| 10/541,952 | 12/01/2005 | Peter James Mawle | M03B107 | 6744 |

71134 7590 12/16/2010
Edwards Vacuum, Inc.
2041 MISSION COLLEGE BOULEVARD
SUITE 260
SANTA CLARA, CA 95054

| EXAMINER | |
|---|---|
| WU, IVES J | |

| ART UNIT | PAPER NUMBER |
|---|---|
| 1776 | |

| NOTIFICATION DATE | DELIVERY MODE |
|---|---|
| 12/16/2010 | ELECTRONIC |

**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

LORETTA.SANDOVAL@EDWARDSVACUUM.COM

| Office Action Summary | Application No. 10/541,952 | Applicant(s) MAWLE, PETER JAMES | |
|---|---|---|---|
| | Examiner IVES WU | Art Unit 1797 | |

***-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --***

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

1)☒ Responsive to communication(s) filed on *05 November 2010*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

4)☒ Claim(s) *1-17* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-17* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

**Application Papers**

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

1) ☒ Notice of References Cited (PTO-892)

2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.

4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .

5) ☐ Notice of Informal Patent Application

6) ☐ Other: _____.

## DETAILED ACTION

(1). Applicants' Amendments and Remarks filed on 11/05/2010 have been received and acknowledged.

Claims 1 and 12 are amended.

The rejections of claims 1-17 in prior Office Action dated 6/21/2010 is withdrawn in view of the present Remarks, Amendments.

However, a new ground of rejections is introduced herein after.

### Claim Rejections - 35 USC § 103

The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

(2). **Claims 1-14** are rejected under under 35 U.S.C. 103(a) as obvious over Tran et al (US 6309532B1) in view of Turner et al (US 5584981A), DiMascio et al (US 5858191A) evidenced by Dingman, Jr. et al (US 6071484A), Pearce et al (US 4477419).

As to step of continuously circulating water through an essentially closed loop incorporating a gas scrubbing unit and an ion absorption unit comprising a water permeable ion absorbing means in a method for treatment of gaseous chemical waste in **independent claim 1**, Tran et al (US 6309532B1) disclose method and apparatus for capacitive deionization and electrochemical purification and regeneration of electrodes (Title). It relates to an electrochemical separation method and apparatus for removing ions, contaminants and impurities from water, fluids, and other aqueous process streams and for placing the removed ions into solution during the regeneration (Col. 1, line 26-30). By using the CDI separation system, it is now possible to remove organic and inorganic contaminants and impurities from liquid streams by the following physiochemical processes, the reversible electrostatic removal of organic and inorganic ions from water or any other dielectric solvent; the reversible or irreversible removal of any organic or inorganic impurities by any other adsorption process, including but not limited to underpotential metal deposition, chemi-sorption, and physic-sorption (Col. 37, line 7-17). More specific applications for CDI system and process include any application where the capacitive

deionizer is used to assist a gas scrubbing column (Col. 37, line 24-26). As shown in the Figure 22, the anion exchange polymeric coating and cation exchange polymeric coating which read on the ion absorbing means. Tran et al **do not teach** the re-circulating water through an essentially closed loop as claimed. however, it would have been obvious to have closed loop with gas scrubber and ion absorption unit in order to use the resource – purified water as evidenced by Dingman, Jr. et al (US 6071484A) in Figure 2, a closed loop scrubbing system is illustrated, Pearce et al (US 4477419) in figure 1, a closed loop scrubbing system.

As to step of feeding exhaust gas or reaction product thereof to the gas scrubbing unit for dissolution in the circulating water thereby to form an aqueous solution containing ionic species derived from the exhaust gas in a method in **independent claim 1**, the gas scrubbing unit disclosed by Tran et al would inherently possess the features as claimed.

As to step of continuously bringing the circulating water into contact with ion absorbing means in the ion absorption unit while applying an electrical potential across the thickness of the ion absorbing means and removing from the ion absorbing unit a more concentrated aqueous solution of ion species in a method in **independent claim 1**, Tran et al (US 6309532B1) disclose Figure 22 which illustrates the features such as an electrical potential across the thickness of the ion absorbing means. Capacitive deionization can, for instance, produce a continuous flow of product water by operating two stacks of carbon aerogel electrodes in parallel. One stack purifies while the other is electrically and/or chemically regenerated (Col. 29, line 53-56). It would remove from the absorption unit a more concentrated aqueous solution of ionic species once the unit is in regeneration mode.

As to step of continuously adding to the closed loop a quantity of water corresponding to the quantity of aqueous solution of ionic species removed from the ion absorption unit in a method in **independent claim 1,** it would be obvious to have a quantity of water continuously adding to the loop because loss of water in regeneration mode, also for the purpose of continuous operation of the system.

As to wherein the added water circulates through the ion absorption unit simultaneously when the electrical potential is applied to the ion absorbing means of <u>the ion absorption unit</u> for removing from the ion absorption unit the new concentrated aqueous solution of the ion species in **independent claim 1**, Tran et al (US 6309532B1) disclose that Fig. 7 illustrates a $2^{nd}$

embodiment of the capacitive deionization-regeneration system 175 using at least two parallel electrochemical cells 30A and 30B, both similar to the cell 30 shown in Fig.3. Of course, when more than two parallel cells are utilized, the operation is at phase differences other than 180°, for example, three parallel cells at 120°, etc. One of main advantages of the system175 is its ability to maintain a continuous deionization and regeneration operations. The system 175 is generally similar to the system 11 and uses two cells 30A and 30B such that when one cell 30A or 30B is deionizing the fluid stream, the other cell is regenerating in the same manner as previously described herein, in preparation for the deionization, i.e., purification process. Therefore, the operation of system 175 is cyclical and continuous (Col. 18, ln.58 – Col. 19, ln. 11). A controller 178 regulates a plurality of inflow and outflow valves 179, 180a, 180b, 180c, 181a, 181b, 181c, and 182, for controlling the flow of the fluid stream to and from the cells 30A and 30B (Col. 19, ln. 21-24). Tran et al (US 6309532B1) **do not teach** adding the water to same ion absorption unit as it is in desorption stage.

However, DiMascio et al (US 5858191A) **teach** Electrodeionization Apparatus and Method (title). In electrochemical ion exchange (EIX) and Capacitive Deionization (CapDI), both the transport and the capacity of the electroactive media are important sizing parameters (col. 3, ln. 19-41).

Therefore, it would have been obvious at time of the invention to replace the Capacity Deionization apparatus of Tran et al by the EIX based on their interchangeability as recognized functional equivalence as deionization unit in water treatment.

Turner et al (US 5584981A) **teach** Electrochemical Deionization (Title). It relates to an electrochemical cell for use in electrochemical deionization and a method for electrochemical deionization. More specifically, though not exclusively, it relates to an electrochemical cell suitable for **continuous operation** when used for electrochemical deionization and a method for the electrochemical deionization. One method for the electrochemical removal of ions from aqueous solutions and onto ion exchange materials may be referred to as electrochemical ion exchange or electrochemical deionization (col. 1, ln. 3-11). It provides an electrochemical cell for use in electrochemical deionization which comprises a water-permeable layer of particulate ion absorbing material, a liquid compartment for liquid undergoing treatment arranged so the liquid comes into contact with at least part of the layer so that ions move through layer to emerge

into eluate zone (col. 1, ln. 50-62). The electrochemical cell and its method of use enable ions to be removed from an aqueous solution, to be stored within the cell and to be removed from the cell as a concentrated solution, without the need, as in conventional electrochemical ion exchange, for reversal of polarity of the electrodes in the cell and elution back into the solution compartment. In addition, the electrochemical cell requires only one feed solution for continuous operation, unlike electrodialysis (col.2, ln. 41-52). It is further illustrated in figures below.

Fig.1.

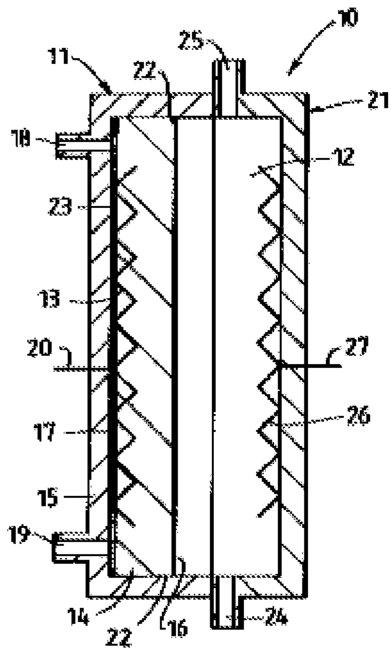
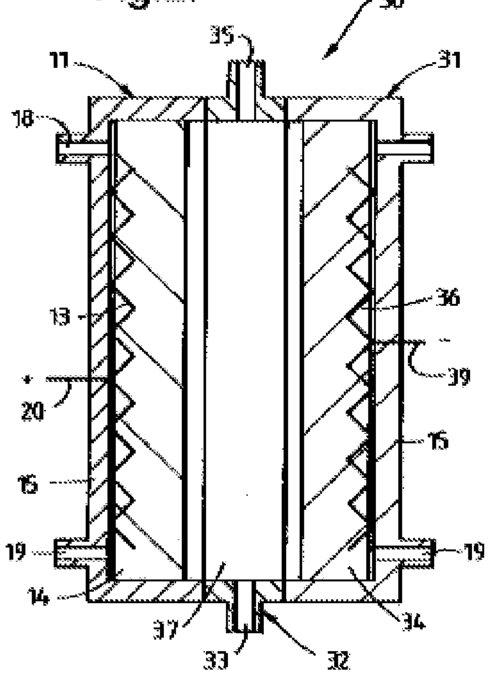



Fig.2.




The advantage of electrochemical deionization by Turner is to operate continuously as described above.

Therefore, it would have been obvious at time of the invention to use the electrochemical deionization unit of Turner for the EIX to replace the Capacitive deionization unit of Tran et al in order to achieve the advantages cited herein before.

As to an essential closed loop circulation system containing a gas scrubbing unit and an ion absorption unit comprising a water permeable ion absorbing means for enabling an electrical potential to be applied across the thickness of ion absorbing means in an apparatus for treating gaseous chemical waste in **independent claim 12**, the disclosure of Tran et al, Dingman, Jr. et al

is incorporated herein by reference, the most subject matters as currently claimed, have been recited in Applicant's claim 1, and have been discussed therein.

As to a pump for continuously circulating water around the closed loop in **independent claim 12**, it would be obvious to have a pump for recirculation as evidenced by Dingman, Jr. et al in Figure 2 including a pump unit.

As to an inlet for exhaust gas or reaction product thereof into the gas scrubbing unit; an inlet for water into the closed loop circulation system; an outlet for concentrated aqueous solution of ionic species from ion absorption unit in **independent claim 12**, it would be obvious to have an inlet for exhaust gas into the gas scrubbing unit in order to scrub the gas. It also would be obvious to have inlet for water in circulation system in order to provide the water. As shown in Figure 22 of Tran et al the outflow which reads on the feature of instant claim.

As to a quantity of the concentrated aqueous solution removed from outlet is replenished by adding water into the closed loop circulation system in **independent claim 12**, the disclosure of Tran et al, Dingman, Jr. et al, Pearce et al is incorporated herein by reference, the most subject matters as currently claimed, have been recited in Applicant's claim 1, and have been discussed therein.

As to wherein the added water circulates through the ion absorption unit simultaneously when the electrical potential is applied to the ion absorbing means of <u>the ion absorption unit</u> for removing from the ion absorption unit the concentrated aqueous solution of ionic species in **independent claim 12**, the disclosure of Tran et al, Turner et al is incorporated herein by reference, the most subject matters as currently claimed has been recited in Applicant's claim 1, and has been discussed therein.

As to continuously circulating water to be brought into contact with one surface of the layer of ion absorbing material in the ion absorption unit and the more concentrated aqueous solution of the ionic species to be removed via the other surface of the layer in **claim 3,** as shown in figure of Turner et al above, the eluate zone with port 19 which on the other side of the layer.

As to ion absorbing means comprising a water permeable layer of ion absorbing material in **claim 2,** and a water permeable zone of an ion absorbing material in **claim 4**, Tran et al (US 6309532B1) disclose Figure 22 which include anion exchange polymeric coating and cation exchange polymeric coating to be water permeable for waste water treatment. Turner et al (US

5584981) disclose a water-permeable layer of particulate ion absorbing material (col. 1, ln. 52-53).

As to the exhaust gas or the reaction product being fed continuously to the gas scrubber unit in **claim 5** and fed intermittently in **claim 6**, it is well known in the art that gas scrubber can be operated in batch or continuous mode, even the gas scrubber is integrated with the ion absorbing means in closed loop, the capacitive deionization apparatus disclosed by Tran et al is able to operate in batch or continuous mode (Col. 15, line 40-44). Turner et al (US 5584981) disclose continuous operation (Abstract). It is not necessary for such a polarity reversal to result in elution from the layer into the solution compartment as would be the case in the conventional use of electrochemical ion exchange; it is only necessay that it be sufficient to overcome the irreversible adsorption of ionic material into the layer (col. 4,ln. 11-16).

As to exhaust gas or reaction product containing HF and ionic species $F^-$ in **claim 7**, exhaust gas or reaction product containing HCl and ionic species $Cl^-$ in **claim 8**, exhaust gas or reaction product containing oxide of nitrogen and ionic species $NO_3^-$ in **claim 9**, exhaust gas or reaction product containing oxide of sulfur and ionic species $SO_4^-$ in **claim 10**, exhaust gas or reaction product containing oxide of phosphorus and ionic species $PO_4^-$ in **claim 11**, Tran et al (US 6309532B1) disclose commercial application including non oxidizable organic and inorganic anions: $OH^-$, $Cl^-$, $I^-$, $F^-$, $NO^-_3$, $SO^{-2}_4$, $PO^{3-}_4$ (Col. 36, line 7-38). By using the CDI separation system, it is now possible to remove organic and inorganic contaminants and impurities from liquid streams by the following physiochemical processes, the reversible electrostatic removal of organic and inorganic ions from water or any other dielectric solvent; the reversible or irreversible removal of any organic or inorganic impurities by any other adsorption process, including but not limited to underpotential metal deposition, chemi-sorption, and physic-sorption (Col. 37, line 7-17). Therefore, it would include the components as listed in the instant claim.

As to ion absorbing means comprising a water permeable layer of ion absorbing material in **claim 13,** and a water permeable zone of an ion absorbing material in **claim 14**, Tran et al (US 6309532B1) disclose Figure 22 which include anion exchange polymeric coating and cation exchange polymeric coating to be water permeable for waste water treatment. Turner et al (US

5584981) disclose a water-permeable layer of particulate ion absorbing material (col. 1, ln. 52-53).

(3). **Claim 15** is rejected under 35 U.S.C. 103(a) as being unpatentable over Tran et al (US 6309532B1) in view of Turner et al (US 5584981A), DiMascio et al (US 5858191A), further in view of Keller (US 5045291), as evidenced by Tomoi et al (US 5350523A).

As to heat exchanger within the closed loop in **claim 15**, Tran et al, Turner et al **do not teach** the heat exchanger as claimed.

However, Keller (US 5045291) **teaches** reactivation of spent alkanolamine (Title). As shown in the Figure 1, a cooler 34 located before the ion exchange.

The advantage of cooler before the ion exchange is to avoid degradation of the absorption medium as well known in the art. As evidenced by Tomoi et al (US 5350523A) in background teaching that detachment would occur in anion exchange resin at high temperature.

Therefore, it would have been obvious at time of the invention to install the cooler of Keller before the ion absorption device of Tran et al in order to obtain the cited advantages.

(4). **Claim 16** is rejected under 35 U.S.C. 103(a) as being unpatentable over Tran et al (US 6309532B1) in view of Turner et al (US 5584981A), DiMascio et al (US 5858191A), further in view of Yan (US 4795565).

As to a filter within the closed loop in **claim 16**, Tran et al, Turner et al **do not teach** filter as claimed.

However, Yan (US 4795565) **teaches** cleanup of ethanolamine to improve performance and control corrosion of ethanolamine units (Title). As shown in the Figure 1, filter 11 located before the ion exchange.

The advantage of filter before the ion exchange is to remove the solid suspension (Col. 3, line 39).

Therefore, it would have been obvious at time of the invention to install filter of Yan before the ion absorption device of Tran et al in order to obtain the cited advantages.

(5). **Claim 17** is rejected under 35 U.S.C. 103(a) as being unpatentable over Tran et al (US 6309532B1) in view of Turner et al (US 5584981A), DiMascio et al (US 5858191A), further in view of Yan (US 4795565). Evidenced by Okada et al (US 4141828).

As to hydro-cyclone within the closed loop in **claim 17**, Tran et al, Turner et al, Yan **do not teach** hydro-cyclone as claimed.

However, it is well known hydrocyclone to be used to separate solid-liquid as evidenced by Okada et al (US 4141828) (Col. 5, line 28-30). Therefore, it would have been obvious to substitute the filter of Yan with hydrocyclone of Okada et al for the ion absorbing device of Tran et al based on their interchangeability as functionally equivalent solid-liquid separation device.

## Response to Arguments

Applicant's arguments, see page 7, Remarks, filed on 11/05/2010, with respect to the rejection(s) of claim(s) 1 and 12 under 103 rejection in view of Tran et al (US 6309532) have been fully considered and are persuasive. Therefore, the rejection has been withdrawn. However, upon further consideration, a new ground(s) of rejection is made in view of Tran et al (US 6309532), Turner et al (US 5584981) and DiMascio et al (US 5858191).

## Conclusion

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to IVES WU whose telephone number is (571)272-4245. The examiner can normally be reached on 8:00 - 5:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Duane Smith can be reached on 571-272-1166. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

Examiner: Ives Wu
Art Unit: 1776
Date: December 7, 2010

/Duane Smith/
Supervisory Patent Examiner, Art Unit 1776